

# **ANALOG ELECTRONIC CIRCUITS**

## **(VTU)**

**3<sup>rd</sup> Sem EC/EE/TC**

### **UNIT 5:**

(a) **General Amplifiers:** Cascade connections, Cascode connections, Darlington connections. (Chapter 5.19 to 5.27)

**4 Hours**

(b) **Feedback Amplifier:** Feedback concept, Feedback connections type, Practical feedback circuits. (Chapter 14.1 to 14.4)

**3 Hours**

### **TEXT BOOK:**

1. "Electronic Devices and Circuit Theory", Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education, 9TH Edition.

### **REFERENCE BOOKS:**

1. 'Integrated Electronics', Jacob Millman & Christos C. Halkias, Tata - McGraw Hill, 2<sup>nd</sup> Edition, 2010
2. "Electronic Devices and Circuits", David A. Bell, PHI, 4<sup>th</sup> Edition 2004
3. "Analog Electronic Circuits: A Simplified Approach", U.B. Mahadevaswamy, Pearson/Saguine, 2007.

### **ADDITIONAL MATERIAL:**

1. "Electronic Circuits", Dr. R S Sedha, S. Chand, 3<sup>rd</sup> Edition, 2012.

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# Vtu Lab Manual For Analog Electronic Circuits

**Yi-Tong Ma**



## **Vtu Lab Manual For Analog Electronic Circuits:**

*Laboratory Manual for Introductory Electronics Experiments* L. K. Maheshwari, M. M. S. Anand, 1979      **Introduction to Analog and Digital Circuits Lab Manual** Brian DEAN, 2018-08-13      **Analog Electronic Circuits and Systems** Gary E. Ford, Carl M. Arft, 2006-06-05      **Analog Electronic Circuits Laboratory Manual** Farzin Asadi, 2024-04-08 This is a book for a lab course meant to accompany or follow any standard course in electronic circuit analysis. It has been written for sophomore or junior electrical and computer engineering students either concurrently with their electronic circuit analysis class or following that class. This book is appropriate for non majors such as students in other branches of engineering and in physics for which electronic circuits is a required course or elective and for whom a working knowledge of electronic circuits is desirable. This book has the following objectives: 1 To support, verify and supplement the theory to show the relations and differences between theory and practice; 2 To teach measurement techniques; 3 To convince students that what they are taught in their lecture classes is real and useful; 4 To help make students tinkers and make them used to asking what if questions.

**Lab Manual for Electronics** Martin Feldman, 2001-11 The emphasis is first on understanding the characteristics of basic circuits including resistors, capacitors, diodes and bipolar and field effect transistors. The readers then use this understanding to construct more complex circuits such as power supplies, differential amplifiers, tuned circuit amplifiers, a transistor curve tracer and a digital voltmeter. In addition, readers are exposed to special topics of current interest such as the propagation and detection of signals through fiber optics, the use of Van der Pauw patterns for precise linewidth measurements and high gain amplifiers based on active loads.

**KEY TOPICS** Chapter topics include: Thevenin's Theorem, Resistive Voltage Division, Silicon Diodes, Resistor Capacitor Circuits, Half Wave Rectifiers, DC Power Supplies, Diode Applications, Bipolar Transistors, Field Effect Transistors, Characterization of Op Amp Circuits, Transistor Curve Tracer, Introduction to PSpice and AC Voltage Dividers, Characterization and Design of Emitter and Source Followers, Characterization and Design of an AC Variable Gain Amplifier, Design of Test Circuits for BJT's and FET's and Design of FET Ring Oscillators, Design and Characterization of Emitter Coupled Transistor Pairs, Tuned Amplifier and Oscillator, Design of AM Radio Frequency Transmitter and Receiver, Design of Oscillators Using Op Amps, Current Mirrors and Active Loads, Sheet Resistance, Design of Analog Fiber Optic Transmission System, Digital Voltmeter.

**Analog Electronics in a Digital Setting** Gerald E. Williams, 1988-01-01      *Experiments in Analog Electronic Circuits* Thomas E. Brewer, Marshall Leach, R. Allen Robinson, 2013-08-09      *LABORATORY EXPERIMENTS AND PSpice SIMULATIONS IN ANALOG ELECTRONICS* L. K. MAHESHWARI, M. M. S. ANAND, 2006-01-01 This laboratory manual for students of Electronics, Electrical Instrumentation, Communication and Computer engineering disciplines has been prepared in the form of a standalone text offering the necessary theory and circuit diagrams with each experiment. Procedures for setting up the circuits and measuring and evaluating their performance are designed to support the material of the authors' book *Analog Electronics* also published by

PHI Learning There are twenty five experiments The experiments cover the basic transistor circuits the linear op amp circuits the active filters the non linear op amp circuits the signal generators the voltage regulators the power amplifiers the high frequency amplifiers and the data converters In addition to the hands on experiments using traditional test equipment and components this manual describes the simulation of circuits using PSPICE as well For PSPICE simulation any available standard SPICE software may be used including the latest version OrCAD V10 Demo software This feature allows the instructor to adopt a single laboratory manual for both types of experiments **ANALOG ELECTRONICS A.**

KANDASWAMY,ANDRÉ PITTET,2009-09-01 The recent growth of industrial automation as well as wireless communication has made the Analog Electronics course even more relevant in today s undergraduate programmes This well written text offers a comprehensive introduction to the concepts of circuit analysis electronic devices and analog integrated circuits The primary aim of this textbook is to raise the analytical skills of students required for the analysis and design of analog electronic circuits This book exposes the students to the current trends in Analog Electronics including the complete analysis and design of electronic circuit using Diodes BJTs FETs MOSFETs CMOS and operational amplifiers **Analog Electronics**

Gerald Earl Williams,1996 This comprehensive electronics text designed for electronics technology majors provides a real world orientation for future working technicians Numerous carefully designed drawings and photos are included throughout to insure that each concept is fully understood Includes the latest analog integrated circuits Digital Applications show students the importance of digital in the analog world All discussions are interrelated by common theme of feedback Specially designed transistor circuit analysis flow charts simplify basic transistor concepts Manageable for one semester Accompanied by superior lab and instructor s manuals and a unique Student Survival Guide for Analog Electronics by the text author ALSO AVAILABLE Laboratory Manual ISBN 0 314 04677 1 INSTRUCTOR SUPPLEMENTS CALL CUSTOMER SUPPORT TO ORDER Instructor s Guide ISBN 0 314 05522 3 Transparency Masters ISBN 0 314 04925 8 Keywords Electronic Devices **Real Analog** Tim Hanshaw,2019-01-02 Real Analog is a comprehensive collection of free educational materials that seamlessly blend hands on design projects with theoretical concepts and circuit analysis techniques Real Analog has the equivalent content of a university level introductory circuits course Developed for university circuits classes by practicing engineers and experienced educators Real Analog is centered on a newly updated 12 chapter textbook and features Exercises designed to reinforce textbook and lecture topics Homework assignments for every chapter Multiple design projects that reinforce and extend theoretical concepts Worksheets to help students complete design projects outside of the lab This book contains the textbook material for the Real Analog Course The Lab Manual will be published separately and is currently coming soon to Amazon For now it can be downloaded from Digilent com real analog The Table of Contents can be seen below Chapter 1 Circuit Analysis Fundamentals 1 1 Basic Circuit Parameters and Sign Conventions 1 2 Power Sources 1 3 Resistors and Ohm s Law 1 4 Kirchhoff s Laws Chapter 2 Circuit Reduction 2 1 Series Circuit Elements and Voltage Division

2 2 Parallel Circuit Elements and Current Division 2 3 Circuit Reduction and Analysis 2 4 Non ideal Power Supplies 2 5 Practical Voltage and Current Measurement Chapter 3 Nodal and Mesh Analysis 3 1 Introduction and Terminology 3 2 Nodal Analysis 3 3 Mesh Analysis Chapter 4 Systems and Network Theorems 4 1 Signals and Systems 4 2 Linear Systems 4 3 Superposition 4 4 Two terminal Networks 4 5 Thevenin's and Norton's Theorems 4 6 Maximum Power Transfer Chapter 5 Operational Amplifiers 5 1 Ideal Operational Amplifier Model 5 2 Operational Amplifier Model Background 5 3 Commercially Available Operational Amplifiers 5 4 Analysis of Op amp Circuits 5 5 Comparators 5 6 A Few Non ideal Effects Chapter 6 Energy Storage Elements 6 1 Fundamental Concepts 6 2 Basic Time varying Signals 6 3 Capacitors 6 4 Inductors 6 5 Practical Inductors Chapter 7 First Order Circuits 7 1 Introduction to First Order Systems 7 2 Natural Response of RC Circuits 7 3 Natural Response of RL Circuits 7 4 Forced Response of First Order Circuits 7 5 Step Response of First Order Circuits Chapter 8 Second Order Circuits 8 1 Introduction to Second Order Systems 8 2 Second Order System Natural Response Part 1 8 3 Sinusoidal Signals and Complex Exponentials 8 4 Second Order System Natural Response Part 2 8 5 Second Order System Step Response Chapter 9 State Variable Methods 9 1 Introduction to State Variable Models 9 2 Numerical Simulation of System Responses Using MATLAB 9 3 Numerical Simulation of System Responses Using Octave Chapter 10 Steady State Sinusoidal Analysis 10 1 Introduction to Steady state Sinusoidal Analysis 10 2 Sinusoidal Signals Complex Exponentials and Phasors 10 3 Sinusoidal Steady state System Response 10 4 Phasor Representations of Circuit Elements 10 5 Direct Frequency Domain Circuit Analysis 10 6 Frequency Domain System Characterization Chapter 11 Frequency Response and Filtering 11 1 Introduction to Steady state Sinusoidal Analysis 11 2 Signal Spectra and Frequency Response Plots 11 3 Frequency Selective Circuits and Filters 11 4 Introduction to Bode Plots Chapter 12 Steady State Sinusoidal Power 12 1 Instantaneous Power 12 2 Average and Reactive Power 12 3 RMS Values 12 4 Apparent Power and Power Factor 12 5 Complex Power 12 6 Power Factor Correction

**Analog Electronic Circuits (For 3rd Semester of APJKTU, Kerala)** Sukumaran P., Analog Electronic Circuits Analog Electronic Circuits R. Northrup, 1990-01-01  
**Analog Electronic Circuits** Robert B. Northrop, 1990 *Lab Manual for Electronic Devices, Global Edition* THOMAS L. FLOYD, 2018-06-19 This laboratory manual is carefully coordinated to the text Electronic Devices Tenth edition Global edition by Thomas L Floyd The seventeen experiments correspond to the chapters in the text except the first experiment references Chapters 1 and the first part of Chapter 2 All of the experiments are subdivided into two or three Parts With one exception Experiment 12 B the Parts for the all experiments are completely independent of each other The instructor can assign any or all Parts of these experiments and in any order This format provides flexibility depending on the schedule laboratory time available and course objectives In addition experiments 12 through 16 provide two options for experiments These five experiments are divided into two major sections identified as A or B The A experiments continue with the format of previous experiments they are constructed with discrete components on standard protoboards as used in most electronic teaching

laboratories The A experiments can be assigned in programs where traditional devices are emphasized Each B experiment has a similar format to the corresponding A experiment but uses a programmable Analog Signal Processor ASP that is controlled by free Computer Aided Design CAD software from the Anadigm company [www.anadigm.com](http://www.anadigm.com) These experiments support the Programmable Analog Design feature in the textbook The B experiments are also subdivided into independent Parts but Experiment 12 B Part 1 is a software tutorial and should be performed before any other B experiments This is an excellent way to introduce the ASP technology because no other hardware is required other than a computer running the downloaded software In addition to Experiment 12 B the first 13 steps of Experiment 15 B Part 2 are also tutorial in nature for the AnadigmFilter program This is an amazing active filter design tool that is easy to learn and is included with the AnadigmDesigner2 AD2 CAD software The ASP is part of a Programmable Analog Module PAM circuit board from the Servenger company [www.servenger.com](http://www.servenger.com) that interfaces to a personal computer The PAM is controlled by the AD2 CAD software from the Anadigm company website Except for Experiment 12 B Part 1 it is assumed that the PAM is connected to the PC and AnadigmDesigner2 is running Experiment 16 B Part 3 also requires a spreadsheet program such as Microsoft Excel The PAM is described in detail in the Quick Start Guide Appendix B Instructors may choose to mix A and B experiments with no loss in continuity depending on course objectives and time We recommend that Experiment 12 B Part 1 be assigned if you want students to have an introduction to the ASP without requiring a hardware purchase A text feature is the Device Application DA at the end of most chapters All of the DAs have a related laboratory exercise using a similar circuit that is sometimes simplified to make laboratory time as efficient as possible The same text icon identifies the related DA exercise in the lab manual One issue is the trend of industry to smaller surface mount devices which are very difficult to work with and are not practical for most lab work For example almost all varactors are supplied as surface mount devices now In reviewing each experiment we have found components that can illustrate the device function with a traditional one The traditional through hole MV2109 varactor is listed as obsolete but will be available for the foreseeable future from Electronix Express [www.elepx.com](http://www.elepx.com) so it is called out in Experiment 3 All components are available from Electronix Express [www.elepx.com](http://www.elepx.com) as a kit of parts see list in Appendix A The format for each experiment has not changed from the last edition and is as follows

**Introduction** A brief discussion about the experiment and comments about each of the independent Parts that follow

**Reading assignment** in the Floyd text related to the experiment

**Key Objectives** A statement specific to each Part of the experiment of what the student should be able to do

**Components Needed** A list components and small items required for each Part but not including the equipment found at a typical lab station Particular care has been exercised to select materials that are readily available and reusable keeping cost at a minimum

**Parts** There are two or three independent parts to each experiment

**Needed tables graphs and figures** are positioned close to the first referenced location to avoid confusion

**Step numbering** starts fresh with each Part but figures and tables are numbered sequentially for the entire experiment to avoid

multiple figures with the same number Conclusion At the end of each Part space is provided for a written conclusion Questions Each Part includes several questions that require the student to draw upon the laboratory work and check his or her understanding of the concepts Troubleshooting questions are frequently presented Multisim Simulation At the end of each A experiment except 1 one or more circuits are simulated in a Multisim computer simulation New Multisim troubleshooting problems have been added to this edition Multisim troubleshooting files are identified with the suffix f1 f2 etc in the file name standing for fault1 fault2 etc Other files with nf as the suffix include demonstrations or practice using instruments such as the Bode Plotter and the Spectrum Analyzer A special icon is shown with all figures that are related to the Multisim simulation Multisim files are found on the website [www.pearsonglobaledition.com](http://www.pearsonglobaledition.com) Floyd Microsoft PowerPoint slides are available at no cost to instructors for all experiments The slides reinforce the experiments with troubleshooting questions and a related problem and are available on the instructor s resource site Each laboratory station should contain a dual variable regulated power supply a function generator a multimeter and a dual channel oscilloscope A list of all required materials is given in Appendix A along with information on acquiring the PAM As mentioned components are also available as a kit from Electronix Express the kit number is 32DBEDFL10

### **Experiments in Analog Electronics** Wayne

Hope,1995-01-01 *Troubleshooting Electronic Circuits: A Guide to Learning Analog Electronics* Ronald Quan,2020-03-27 Publisher s Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product Debug Tweak and fine tune your DIY electronics projects This hands on guide shows step by step how to build debug and troubleshoot a wide range of analog electronic circuits Written by electronics guru Ronald Quan Troubleshooting Electronic Circuits A Guide to Learning Analog Circuits clearly explains proper debugging techniques as well as testing and modifying methods In multiple chapters poorly conceived circuits are analyzed and improved Inside you will discover how to design or re design high quality circuits that are repeatable and manufacturable Coverage includes An introduction to electronics troubleshooting Breadboards Power sources batteries battery holders safety issues and volt meters Basic electronic components Diodes rectifiers and Zener diodes Light emitting diodes LEDs Bipolar junction transistors BJTs Troubleshooting discrete circuits simple transistor amplifiers Analog integrated circuits including amplifiers and voltage regulators Audio circuits Troubleshooting analog integrated circuits Ham radio circuits related to SDR Trimmer circuits including the 555 chip and CMOS circuits

### **Analog Electronic Circuit** Beijia Ning,2018-09-24

A comprehensive collection of fundamental principles and applications of analog electronic circuits including semiconductor diodes bipolar junction transistors field effect transistors FETs operational amplifiers power amplifiers and feedback circuits With abundant practical examples it is an essential reference for researchers students and engineers in electronical engineering and information processing

### **Analog Electronic Circuits** A. P. Godse,2009

Diode Circuits Diode resistance Diode equivalent circuits Transition and diffusion capacitance Reverse recovery time Load line

analysis Rectifiers Clippers and clampers Transistor Biasing Operating point Fixed bias circuits Emitter stabilized biased circuits Voltage divider biased D C bias with voltage feedback Miscellaneous bias configurations Design operations Transistor switching networks PNP transistors Bias stabilization Transistor at Low Frequencies BJT transistor modeling Hybrid equivalent model CE fixed bias configuration Voltage divider bias Emitter follower CB configuration Collector feedback configuration Hybrid equivalent model Transistor Frequency Response General frequency considerations Low frequency response Miller effect capacitance High frequency response Multistage frequency effects General Amplifiers Cascade connections Cascode connections Darlington connections Feedback Amplifier Feedback concept Feedback connections type Practical feedback circuits Power Amplifiers Definitions and amplifier types Series fed class A amplifier Transformer coupled class A amplifiers Class B amplifier operations Class B amplifier circuits Amplifier distortions Oscillators Oscillator operation Phase shift oscillator Wienbridge oscillator Tuned oscillator circuits Crystal oscillator FET Amplifiers FET small signal model Biasing of FET Common drain common gate configurations MOSFETs FET amplifier networks

Fundamentals of Electronic Devices and Circuits Lab Manual David Bell, 2009-11-22 The laboratory investigations in this manual are designed to demonstrate the theoretical principles set out in the book Fundamentals of Electronic Devices and Circuits 5 e A total of 43 laboratory investigations are offered involving the construction and testing of the circuits discussed in the textbook Each investigation can normally be completed within a two hour period The procedures contain some references to the textbook however all necessary circuit and connection diagrams are provided in the manual so that investigations can also be preformed without the textbook



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web water can be harnessed on a large or a small scale table 1 below outlines the categories used to define the power output form hydropower micro hydro power is the small scale harnessing of energy from falling water for example harnessing enough water from a local river to power a small factory or village

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